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# THE COLONIAL NEWSLETTER

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THE ORIGINAL OBVERSE HUB DESIGN
for
THE FUGIO CENTS of 1787

Sequential page 812

**An Overview of Early American Coinage Technology (Continued)**

**by J. C. Spilman**

## ● TOOLS OF THE DIE-SINKER

The final topic for discussion in our Overview of Early American Coinage Technology covers die-sinking tools. It was, of course, absolute necessary in the operation of a mint to have a ready source of coinage dies , and on this subject we have available very little documentation and almost no extant tooling for examination. We do know from the literature the names of a few individuals in America who were reported to have had the skills and experience for the manufacture of coinage dies. Prominent among these were Abel Buell of Connecticut (Fugio and Connecticut Dies), James F. Atlee (Machin's Mills issues and some Vermont Dies), Joseph Collender of Boston and Jacob Perkins of Newburyport (Massachusetts Cent and Half Cent dies), Walter Mould, John Bailey and Thomas Goadsby (New Jersey dies), William Cooley of New York (Vermont dies) and Ephram Brasher of New York. Several others names could be added to this list but it is uncertain whether they were die-sinkers, per se, or were coiners or merely partners in coining enterprises. In any case they left us nothing other than their coinage product as evidence of their skills and techniques.

Even Samuel Thompson of Dublin who proclaimed himself on the frontispiece of his manuscript (CNL p.768) as Die=Sinker makes only slight mention of dies. The first is with reference to his coinage press sketch where a die is shown in the lower right hand corner (CNL p.765). He comments "Fig. 3rd is a Die, the exact size and shape of those used in the Tower." The second appears in a notation on labor expense "Die sinker for dies necessary for one year -- 300:00:00." This amount is exactly the same as his estimated total cost for all the machines, tools and and furnaces, including an edge milling machine, to equip the entire mint!

Evidently the salary of the die-sinker was the major labor cost item of the entire operation. Thompson left blank his estimate for the salary of the Mint Master, but the annual salary for the Assay Master was given as £ 200:00:00, plus two workmen at £ 100:00:00 each, and a Porter at £ 30:00:00, but as to the necessary skills, tools, duties and even the number of dies to be provided, Thompson leaves us guessing. In his detailed treatise on 18th century coinage techniques, Samuel Thompson, whoever he was and whatever his credentials, keeps his personal skills and die-sinking knowledge completely to himself!

A detailed discussion of the historical evolution of coinage technology and especially the manufacturing methods for dies is well beyond the limited scope of our Overview. Besides, it has already been very nicely accomplished by Walter Breen in his booklet "Dies and Coinage."[20] An interesting observation that Walter makes in his booklet is that the evolution of coinage technology flowed, in general, from Italy to France to England, and then to America. Our

comparisons of the techniques and machines of Diderot, Thompson and others, and the Early American mints have followed this same general sequence which, we suppose, is a natural consequence of the historical development of minting practice.

So far as we know there is no Early American coinage die, hub, matrix, letter punch or other tool in existance today. Hopefully something will turn up in the future; however, this leaves us once again with only the coinage itself to provide information. Accordingly, any discussion of die sinking techniques must be extremely limited, but once again, coinage imperfections fill in some gaps and provide a few answers.

Early numismatic writers such as John H. Hickcox (1858), Montville Dickinson (1859), Sylvester S. Crosby (1873), and Edward Maris (1881) established the die variety catagorization schemes which were expanded in later years by Henry C. Miller (1919) and Hillyer Ryder (1919) who added greatly to the basic die variety descriptions and somewhat to the photographic support of these descriptions. Even today adaquate photographic documentation for all of the Early American die varieties does not exist. These writers' basic worksand their attribution techniques remain in use today essentially unchanged.

These early numismatic writers would note the repetitive use of certain letter and ornament punches used in the preparation of various dies, and that different punches appeared from time to time, large letter punches for example, but this seems to have been the limit of their interest in the die making process. It was a major undertaking in those formative years just to discover, sort out and catagorize the various coins into similar groupings.

Even in our early days of technological curiousity, specifically the era of Sylvester S. Crosby, Edward Maris and Henry C. Miller, certain die related evidence was recognized as being obvious. Dies cracked with useage, and these investigators included significant die cracks, and sometimes the progressive development of cracks in their descriptions of die varieties. It was obvious that a coin exhibiting a small crack was produced earlier in time than another on which the crack showed extensive development. Once in awhile an investigator would note the change in curvature of a die surface by observing that the coinage showed a bowing up of the field resulting from the sinking of the face of the die through continued use, but usually these early investigators only generated detailed descriptions of each die variety by cataloging minute differences in observable details of letter positions in legends relative to each other and to prominent features of the central designs sufficient to establish with certainty that a particular specimen was <u>different</u> from another and, therefore, originated from a different die. Sometimes the more obvious identifiers - such as a double cut legend letter - were specifically noted. Often this was carried to extremes. These precisely

written detailed descriptions, generally without the benefit of supporting photography, became the bane of modern collectors and are in themselves enough to discourage any more than a passing interest in the die varieties of the Early American coinages.

Only in recent years has any serious consideration been given to the reasons for all of the trivia that went into these die descriptions. A trend in thinking has developed toward answers explaining this trivia and the technological reasons for the differences that permit distinguishing one die variety from another.

Today, however, it is absolutely essential to consider similarities rather than differences in die varieties if one is to recognize the methodology of manufacture. This is a complete reversal of all of the long established concepts of our early numismatic researchers whose total thought process was based on differences between die varieties. An obvious difference was justification for catagorizing a new die variety, and that was that!

Through the collective efforts of CNL Patrons a realization has emerged that die making was a considerable part of the overall effort in an Early American mint. Without dies there was no coinage, and the cost of the dies, based on Thompson's figures, must have been tremendous!

Assembling all of the necessary coinage presses and cutting presses, rollers, smelters, heat treating furnaces and other mint production machinery must have been a relatively simple task compared with the job of obtaining coinage dies. The only more difficult task seems to have been that of obtaining the copper.

The skill necessary for die sinking was probably an anomoly of the times. The artistic talents and skilled use of a graver would be found in a goldsmith or silversmith or sculptor, but the skills for working in very hard metals - wrought iron and steel - the forming of die blanks and the like, were those of the blacksmith. One a genteel luxury craft for service to the wealthy, and the other the hot and dirty work of supplying the basic metallic needs of the ordinary citizen of early America. This combination of talent would normally be expected in the trade of the cuttler or gunsmith. The die-sinker must have been an admixture of all these crafts, and a very unusual individual! Keep in mind that the die-sinker for a minting operation would need to be capable of producing and maintaining all of the components necessary for the manufacture of dies from the die blanks to assorted punches, gravers and files as well as the heavy machinery - screw and drop devices - and furnaces. All this plus the artistic talent to render these things into engraved and lettered die faces capable of producing a visually attractive coinage product. It was without doubt an extremely demanding task!

We know from the studies of Walter Breen and others the general techniques used for the manufacture of dies in Europe. The overall design for a coin was transferred onto a die face either by cutting away the metal by graver, or by the use of letter punches and central device punches all created by hubs of various complexity. In America Abel Buell used these same methods but he carried them one step further through the use of a complex hub containing all design features in the production of his 1786 Connecticut dies.[21] This was the most sophisticated technique employed in America - others used more conventional techniques - but in later years Buell reverted to the use of much less complex hubs in conjunction with letter and ornament punches. We have concluded that the complex hub approach resulted in substantial amounts of hand finishing being required on the individual dies (because of the numereous imperfections in the technique) and in the long run he may have concluded that it was less time consuming to produce a large quantity of dies in the more conventional manner. We also do not know whether Buell's complex hub technique involved sinking a hub into a die blank mounted in a mechanical press, or whether it consisted of a casting process. The manufacture of coinage dies by casting bronze in a ceramic mold is an ancient process developed during Greek and Roman times.[22] It may well have been that Buell, being a skilled lapidary familiar with the uses of minerals, used a similar technique to produce those 1786 Connecticut dies. Additional study should confirm or disprove this idea.

Some twenty five years after publication of "Early Coins of America" Sylvester S. Crosby made an outstanding Fugio discovery. In the January 1902 issue of The American Journal of Numismatics (AJN)[23] he published an article titled "Notes on an Undescribed Trial-Piece Bearings Impressions of Two Hubs for a Fugio Pattern." This copper specimen, examined and described by Crosby, was indeed struck between two working hubs rather than dies. Crosby says "As this piece was struck between two hubs, it shows a incised or intaglio and reversed impression; that is to say, the hub being in relief or repousse on both obverse and reverse, it produced an incused die, with legends and devices reversed."

Crosby goes on in great detail to discuss differences from the regular Fugio coins and because of these differences concluded that both of these hubs were to have been used to manufacture dies for Fugio "patterns", hence his title for the article.

As supporting evidence Crosby also presented a description of the then known techniques for producing dies, and states "For information ... I applied to Mr. Henry Mitchell, the well-known seal and die engraver, who kindly explained the process of making dies before the introduction of modern inventions, and confirmed my theory of the method probably employed in making the hub of which the piece under notice supplies the evidence.

"The process is in effect as follows: A matrix for each part of the design is made and hardened; from each of these matrices a hub is produced, which is also

hardened. Following the same method, the legends are added, each letter being separately impressed in the die by a steel punch. The next process is the assembling of these several parts for an intaglio, or incused, impression in a steel blank; this, if satisfactory, becomes the matrix, or "mother-die," from which a hub in relief, or technically in repoussé, may be obtained for the production of duplicate dies. If unsatisfactory, alterations are made upon this hub, and another blank is impressed with it, in which still further alterations may be made, and so on successively, altering sometimes the hub, sometimes the die, the latter finally giving the result of the different changes through which the hubs and dies have gone as the work advanced, until a satisfactory result has been attained."

Readers with an interest in Crosby's detailed discussion of differences between the trial-piece and the Fugio varieties described in "Early Coins of America" should consult the AJN article as these comparisons do not serve any useful purpose in our present discussion. We certainly must give Crosby credit for a first attempt in American numismatics to explain the reasons for the differences in dies and how they came about! Our point, however, is that Crosby was still so involved in the minute differences that he neglected to study the striking similarities with the regular Fugio coinage and therefore totally failed to recognize the original obverse (sun-dial) hub design for the Fugio Coppers!

Crosby had constructed several replicas of the two sides of this trial-piece. Illustrated on the frontispiece of this issue is one of these replicas. This is an extremely well made impression from the sun-dial side of the trial-piece. It appears to have been manufactured by spreading a thin layer of molten lead/tin alloy on a sheet of copper and then pressing the trial-piece into the molten alloy to obtain a permanent impression, just as a die would strike a coin. Photo-optical comparisons of this impression with Crosby's trial-piece show that it is a dimensionally accurate duplicate and that all features were precisely transferred. We do not know of the existance of a similar impression of the reverse of the trial-piece. Other extant uniface replications in gold bearing the name J.Jarvis on the back side are not dimensionally accurate and are believed to have been made by others at some later date. Also illustrated on page 818 are enlarged photographs of both obverse and reverse of Crosby's trial-piece.[24] These photographs were made in the CNL photographic facility. As we look at these illustrations we should recognize that we are seeing exactly the same design configuration that a die-sinker would view looking down at a die face after the hub had been sunk into that die face and before the legend lettering and ornamentation was added.

Crosby's trial-piece tells us even more than an original die could do because it represents an intermediate step in die manufacture. Note in particular that the trial-piece shows both the central device design plus the surrounding border dentils. This working hub configuration was used by Abel Buell for his 1787 Fugio dies and also for his 1787 Mailed Bust Left Connecticut dies, and their respective reverses. That is - the central device surrounded by the border

**CROSBY'S TRIAL-PIECE**

**2.5 X ENLARGEMENT**

pattern. This configuration represents the next evolutionary step in die-sinking technology following his complex-hub technique used for the 1786 Connecticut dies. The border dentil design appears to have been fabricated by cutting the dentil pattern into the end of a tubular metal pipe, and this pipe-die tool was then used as a master punch to impress the border pattern into a matrix which was then used as the master matrix for the production of working hubs. Crosby's trial-piece was impressed between two such working hubs. This same pipe-die was used for the Fugio hubs and for the 1787 Connecticut hubs; the patterns are identical and match like cogs of a gear when compared photo-optically.

This discussion assumes that our readers are familiar with the terminology of die die-sinking tools. All of us probably have a good understanding of dies and we will illustrate a master hub later in this discussion, but the intermediate tooling may be more obscure. Crosby's trial-piece is an impression made between two working hubs. To help in understanding this terminology we call our readers attention to the recent discovery and publication of a die, punch and matrix for the Virginia Halfpenny coinage of 1773 which are located in the Royal Mint collection in London.[25] This discussion and the illustrations will help in understanding the intermediate steps between working hubs and master hubs (or punches) in 18th century die manufacture. Illustrated in the article are central device working punches (hubs) for obverse and reverse dies, a working matrix for the obverse punch, and an unfinished die. The terms punch and hub and the terms die and matrix are often used interchangeably because they are identical in appearence and differ, actually, in the manner in which they are used.

One other major die sinking tool is required to produce a series of working dies, and that is a master hub (or punch). The master hub is the first product of the die-sinker, hand carved in extremely high relief using the highest quality "tool grade" steel available. It is an exquisitely sculptured work of art. After polishing and heat treating the sculpture is protected from mechanical stress by being shrunk fit into an encasing steel ring whose compressive forces protect it from spreading while it is being forced into the material that will comprise the working matrix. Illustrated on page 820 is such a master hub.

This tool is a master hub (master device punch) produced by the famous French die maker Jean Pierre Droz who worked for several years with Matthew Boulton at the Soho Mint in England.[26] Droz was offered an opportunity to come to America in 1793 to work at the U.S.Mint, as desired by Thomas Jefferson, but declined the opportunity saying that he got so terribly sea sick each time he crossed the English Channel that he simply could not face an ocean voyage!

This Droz hub was used in the production of the reverses of several Admiral Nelson medals (Bramsen 436 & 437, and possibly others). During use the hub suffered damage in several places, most notably in the area of the trident points. Portions of the two outer points broke off and only the central point remains intact today. This progressive breakup of the master hub can clearly be seen today on the various medals; the final dies required careful handwook to reconstruct the damaged areas.

Our purpose here is to illustrate the nature of a major die-sinking tool. Other writings will cover the history of this hub and the specifics of its use in the production of the Nelson medals. This master hub is not physically configured like a die. It is, instead, a flat disk composed of two parts. The inner section is high quality tool steel (circa 1790) out of which the very high relief engraving was accomplished. The outer section is a heavy ring which appears to have been shrunk fit around the inner section to prevent spreading during sinking into a matrix.

The engraved central section of this master hub is sculptured in three stages. Stage 1 is the principal design itself. Stage 2 is the backup engraving which physically supports the Stage 1 design detail. See the enlarged photograph of the trident points on page 821 . Stage 3 is the metal base, or field, of the hub. Only the uppermost portions of Stage 1 details are sunk into a matrix; thus, Droz's signing of the hub in the Stage 3 field would never appear on either a matrix or a die produced from the hub.

The master hub for the Fugio sun-dial would have looked very similar to the Droz master hub. It comprised the basic sun-dial design with its internal details as they appear on the Crosby trial-piece.


**J. P. DROZ HUB**
**1.25 X ENLARGEMENT**

**OBLIQUE VIEW of DROZ HUB**


**ENLARGEMENT of DROZ HUB DESIGN DETAILS**

**5.25 X ENLARGEMENT**

We believe the border dentil design was added to a matrix containing an impression from the master hub using the earlier mentioned "pipe-die" punch. Then, from this matrix, some quantity of working hubs were raised to be used for the manufacture of production dies to which individual legend letters and numerals, ornaments and central design changes were added on each die.

In earlier Fugio studies [27] we established that a major design error was made during the cutting of the ring of roman numerals on the sun-dial plate. Specifically, an extraneous fifth upright was added to the numeral IIII. Crosby's trial-piece shows considerably greater detail in this area than does any of the extant coinage and reveals that the mistake was more serious than earlier believed. Layout lines extend from the bottom (inner) end of the extraneous upright showing that the engraver - whom we believe to have been Abel Buell - was in the process of adding a complete V to the IIII before he realized his mistake. Having begun the removal of metal from the sculptured design he was stuck with his error which he chose to hide on each die by punching an olive ornament over the error. It was then necessary to add olives between each of the numerals on the dial plate to balance the design. We are certain that this is an olive because the same punch was used by Buell to ornament the olive branch, containing leaves and olives, in the right hand of Ms. Liberty on some of his 1787 Connecticut dies.

The original hub design for the Fugio obverse appears to be somewhat lacking in strength and boldness. Evidently Abel Buell and James Jarvis (and possibly the Federal design review committee) felt the same way. Accordingly, in addition to the olives, they added by hand on each die a pebble surface to the central dial plate, and this obscured the existing floral design, and then reconstructed the identical floral design by punching new patterns into the central dial plate. The eyes of the sun were also enhanced by punches. Then the legend letters and various ornamentation were added. It appears that the MIND YOUR BUSINESS lettering below the sun-dial was added utilizing either a lettering guide or a logotype which is a punch having multiple letters. Three may have been used, one for each of the three words, but additional investigation is necessary before a positive determination can be made.

These additions on individual Fugio dies were rather extensive and were carefully accomplished; however, they failed to complete obscure the original floral design on the interior of the dial plate. Photo-optical comparisons of the sun-dial on Crosby's trial-piece with individual coinage die varieties indicate that vestiges of the original floral design remain. These vestiges have been identified on obverses 5,7,8,12,13,15,16 and 18. It is very helpful to know what to look for! Crosby's trial-piece provides this guidance and represents a unique opportunity in Early American numismatics.

A knowledge of the general production techniques for Early American coinage dies enables us to reach new conclusions regarding the extant coinage. It is now possible to determine with reasonable certainty the emission sequence of various die varieties, the general sequence of usage of working hubs and punches, and even the sequence of manufacture of production dies.

Just as the Droz hub suffered damage during use, so did the Fugio obverse hub. This damage is most apparent at the ends of the rays radiating from the sun. In its terminal state (recognizing that there was probably more than one working hub) it produced the "Club Ray" Fugios. At this stage the rays had disintergrated to the degree that required their almost total reconstruction on individual dies sunk from this hub, and whoever accomplished the task did not seem to care to expend the necessary time to do it correctly, so they simply added the heavy "Club" rays to fill in the spaces. Vestigal remains of the fine rays are there and can be observed on each of the "Club Ray" varieties. This progressive hub damage, but to a much lesser degree, can also be recognized on the "Fine Ray" varieties. Similar hub disintergration can be seen on the central devices of the various Connecticut dies.

It is also of importance to understand the effects of various tools on the metals used for coinage dies. These effects are best determined by experimentation and it is the need for accomplishment of this experimentation that is one of the driving forces toward the Foundation's goal to establish a reconstruction of an Early American mint which would include the experimental usage of tools and metals closely representing those available during the 1785 to 1788 time period.

Some of these metal effects are already well known but have not been clearly recognized in their numismatic connotations. For example, when a punch is driven into a die face the metal is not removed - it is displaced - and must go somewhere. We know that it tends to move aside and to rise up around the immediate edge of the punch. On the other hand, in engraving the metal is actually cut away rather than being forced elsewhere and thus does not create the severe rise of metal in the vicinity of the punch. A very important step in the the manufacture of a die was accomplished by polishing the die faces, sometimes the word grinding is used, in a manner similar to modern lapidary practice of polishing large mineral specimens.

If this polishing is not sufficient to remove the ridges of metal, then the raised features on a coin will have the strange appearence of sinking into the field, and on rare occasions this effect is encountered on coinage specimens.

In most cases the polishing was overdone. That is - carried well beyond the point necessary to produce a good die - and at times was carried to the point that some of the design detail was polished completely off the die. That still happens today in modern die manufacture. It is generally believed that the main purpose of die

polishing was to produce a bright field on the finished coin, which it did, but the more essential purpose was to remove those metal ridges which, if not removed, resulted in a very strange and unattractive looking coin!

Following polishing the die was hardened by heat treating and placed into service. Improper heat treating produced a large quantity of defective coinage. Excessive hardening resulted in brittle dies that cracked easily while insufficient hardening resulted in a too soft die face that would sink with usage and produced a coin having a bowed-up-in-the-center appearence. There is considerable evidence to suggest that attempts were made to repair damaged and defective dies by repolishing the die to remove the surface defect. The most spectacular example of this is the "Horned Bust" Connecticut of 1787, Miller obverse 4. See the illustrations on page 825. Here an attempt was made to repair the small die crack by polishing. It may have worked for awhile but the crack continued to develop into the die and more and more metal chipped away. The results of die polishing can best be seen in the area of hair just below the ear. Much of this detail was removed during the ineffective polishing effort.

In the most extreme cases the image was almost entirely ground off the die and the die blank then reused . This appears to have occurred several times in the early years of the Connecticut coinage. An example is the following 1785 Connecticut varieties: 6.3-G.1, 6.3-G.2 and 1-E. These are diagrammed on page 826 as they appear on the CNL Experimental Die Analysis Chart for the Connecticut Coppers.[28] Photo-optical comparisons seem to suggest that these five die varieties, combined into three combinations, issued from only two die blanks. These results are tentative because we do not yet have sufficiently accurate photographic equipment to make an absolutely positive determination.

Our preliminary conclusions regarding this sequence is that the original G.2 reverse was repolished and so drastically reworked that Miller failed to recognize it and identified the reworked die as G.1 which was in turn again drastically reworked and became E. Sometime during this chain of events Obverse 6.3 was reworked and became known as Obverse 1. There is no question that today these varieties are quite different but an analysis of the exact similarities suggests the sequence outlined above. The final result, if this analysis is correct and there were no other reworkings prior to the Obverse 6.3 and Reverse G.2 die states, is that only two die blanks, two chunks of metal, produced five different coinage varieties!

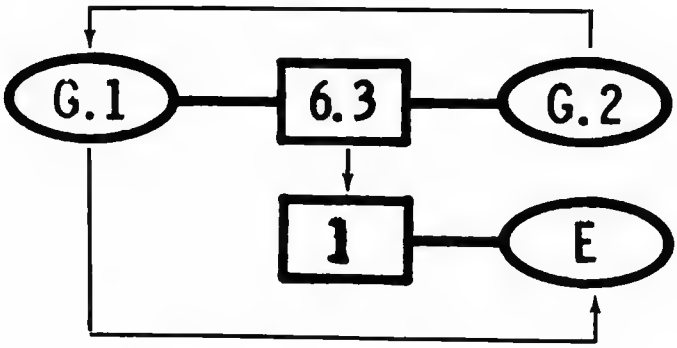
All sorts of accidents befell dies during their use. They were slammed together without a planchet between them and die-clash marks appeared on subsequent coinage. They cracked and these were sometimes repaired by the die-sinker by polishing. Sometimes things fell onto them as in the case of NOVA 1-A where just below the ATIO in CONSTELLATIO appear the border dentils of some other die that was probably dropped on it. It appears that die maintenance was a continuing problem in Early American mints as well as other mints and that the die-sinkers task did not end with the initial fabrication of a die.


EARLY DIE STATE
(BEFORE REWORK)


LATE DIE STATE
(AFTER REWORK)

**CONNECTICUT OBVERSE 4 of 1787**

**3.25 X ENLARGEMENT**




**DIE ANALYSIS CHART SHOWING**
**PROBABLE SEQUENCE of DIE REWORK and USAGE**


G.1 6.3 G.2


1 E

**REWORKED DIE VARIETY GROUP (1785)**

We have not mentioned in this discussion the reverse (ring-side) of the Crosby trial-piece because it may not represent the original hub design as did the obverse. It appears to be a derivitive hub and very possibly a true pattern as Crosby believed even though no coinage is known to have been produced from it. We have not studied this side to the same degree as the obverse or made an attempt to establish its position within the developmental sequence of the Fugio reverse designs. Let it suffice to say at this point that we believe the reverse (ring side) design started with much greater complexity of design and became much simpler in the final version, just the opposite of the evolution of the obverse design.

## ● CONCLUSION:

This completes our Overview of Early American Coinage Technology. While it may appear from this discussion that a great deal is known regarding Early American coinage techniques and die manufacture, far more remains unknown. All of the conclusions made during these discussions are based entirely on visual observations as we said in the beginning. Today, modern technology is capable of analysis in depth in the fields of metallic fabrication techniques. It is a second goal of The Colonial Newsletter Foundation to establish the specialized laboratories and to develop the procedures necessary to provide answers to questions that we are now just learning to ask regarding Early American numismatics. The answers are there - within the coinage itself - and we can find them even though we may never locate an original Early American coinage die, hub, punch or other tool!

Do we have enough basic data at this point in time to reconstruct an Early American mint? We believe the answer is yes; but, it must be realized that such an endeavor would require a considerable amount of iterative learning. The first collection of equipment and facilities would be but a beginning - an opportunity to experiment and to learn the many problems that faced our Early American coiners, and to duplicate the techniques that produced the copper coinage of early America. It will be a substantial undertaking.

Samuel Thompson described such an undertaking to process not only copper coinage but gold and silver as well. Did he succeed? Was his purpose only to document the technology of the times, as was Diderot's, or did he seek to establish a working mint someplace in Ireland? Perhaps we may never find out, but nevertheless his manuscript serves us well today as we attempt to tie together all of the bits and pieces provided by others. As always, our Patron's comments and suggestions will be appreciated.

## ● ACKNOWLEDGEMENTS:

This Overview has presented a number of new concepts and ideas in the field of Early American numismatics. It is the product of many individuals, gleaned over a considerable number of years, who have cooperated in obtaining data and discussing the results through correspondance and in the pages of CNL. The majority are Patrons of The Colonial Newsletter Foundation, and others were simply kind enough to share their knowledge, to advise in a constructive spirit, and to assist when requested. We sincerely thank each one of you.

We owe special recognition and thanks to the following organizations and individuals for their specific contributions and insight:

The American Numismatic Society
Especially two former Directors of the Society, Mr. Sawyer McA. Mosser and Mr. George C. Miles, now both deceased, who assisted in obtaining film copies of manuscripts in the Society's Library for our use. Also - Mr. Francis D. Campbell, Jr., Librarian, for checking Society records and documents for answers to specific questions regarding content.

Edward R. Barnsley of Beach Haven, New Jersey
If any one contributor deserves special recognition for our production of this Overview it is Ned Barnsley whose persistent questioning regarding peculiarities of the Connecticut Coppers and his personal interest in coining presses were the principal driving forces behind the assembledge of data for the Overview. Ned provided many of the illustrations of fly presses and originated the idea of the "cookie cutter" planchet tool.

Theodore L. Craige (deceased)
Ted Craige was another enthusiastic researcher of the Connecticut Coppers whose curiousity regarding similarities as opposed to differences resulted in a number of discoveries that led to the arrangements of many of the die varieties as they appear on the CNL Die Analysis Chart and in particular G.1, 6.3, G.2, 1 and E varieties discussed in the Overview.

John J. Ford, Jr. of Rockville Centre, New York
Our special thanks to John for permission to photograph Crosby's Trial-Piece and for associated information regarding its' history and that of related specimens.

Robert J. Lindesmith of Dayton, Washington

It was Bob's keen observations and questioning of similarities between the varieties of 1786 Connecticut Coppers that first brought to light the need to change our long established mindset for considering only differences observable on Early American coinage specimens.

Richard Picker (deceased)

The numismatic spirit of Richard Picker is alive and well in this Overview. His knowledge and influence are pervasive. He was continually searching, finding and sharing his discoveries with others and he never failed to provide assistance when it was requested. Shortly before his death in February of this year he telephoned ye Editor from Florida and asked that we not send him a research file that he had requested earlier; he said that he would not be needing it - that his illness has worsened and that he would return to New York - and he said goodby.

Gary A. Trudgen of Endwell, New York

The supporting data regarding Thomas Machin and Machin's Mills was provided by Gary Trudgen. Significant new personal data regarding Thomas Machin has been researched and compiled by Gary and will appear in the next issue of CNL.

Raymond H. Williamson of Lynchburg, Virginia

Special credit is due Ray for sharing his discovery of the J. P. Droz hub and for allowing us to study and photograph it and for his permission for use of that data in conjunction with our Overview.

Photographic Credits

Diderot Plates - from microfilm provided by the Library of the City of New York through the courtest of Edward R. Barnsley.
Connecticut 5.5-M of 1787, p.784, from John D. Wright.
Fugio 8-B, p. 789, from David Sonderman.
Fugio 12-X, p.798, from The American Numismatic Society.

All photographs were made by The Colonial Newsletter Foundation.

**NOTES to An Overview of Early American Coinage Technology (Continued)**

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22. Rohner, Robert R. "Ancient Coin Dies: Engraved or Cast?" The Numismatist, Volume 96, No. 5, May 1983, pages 929-931.

23. Crosby, Sylvester S. "Notes on an Undescribed Trial-Piece Bearing Impressions of Two Hubs for a Fugio Pattern." The American Journal of Numismatics, January, 1902, Volume 36, No. 3, pages 76-80 with plate.

24. This is a new photograph of the trial-piece made by CNL. The illustration in AJN is very poor and we were unable to locate a copy with suitable resolution for reproduction. The AJN plate contains seven photographs and four wood cuts which support Crosby's comparisons with illustrations contained in his "Early Coins of America."

25. Dyer, Grahm and Gaspar, Peter P. "A Virginia Numismatic Discovery", Museum Notes No. 27, pages 231-237 and plates 30 & 31. The American Numismatic Society, New York, 1982.

26. This Droz Hub was discovered in 1976 by CNL Patron Raymond H. Williamson. It was a part of a 50,000 piece collection sold for a Tennessee client by a North Carolina firm in a series of mail bid auctions.

27. Spilman, James C. "Some Comments on the Fugio Cents of 1787", The Colonial Newsletter, Volume 2, No. 3, July 1961, Serial No. 4, sequential pages 24-32.

28. Spilman, James C. "An Experimental Die Analysis Chart for the Connecticut Coppers", The Colonial Newsletter, Volume 16, No. 1, March 1977, Serial No. 48, pages 572-577.